Electronic Version
Stylesheet Version v1.1.1

Claims

[c1] What is claimed is:

1.A method of predicting the operation of a steerable drilling system comprising the steps of:

calculating an ideal reachability ellipse;

inputting data representative of actual drilling conditions into a parametric model;

calculating predicted build and turn gain, cross-coupling and bias values to derive build and turn responsiveness values attainable under given operating conditions from the parametric model to produce a predicted reachability ellipse;

plotting the predicted reachability ellipse and ideal reachability ellipse on a diagram to compare the predicted build and turn responsiveness to the ideal response for one or more sets of operating conditions.

[c2] 2.A method as claimed in Claim 1, wherein the model data includes data representative of at least one of: weight on bit, rotational speed, rate of progress, torque, pressure, inclination, dip and azimuth of bedding planes or other formation characteristics, hole curvature/gauge or other geometric conditions, bit type and condition,

and errors in instrumentation readings.

[c3] 3.A method as claimed in Claim 1, wherein the predicted reachability ellipse diagram is calculated using the equations;

$$Build = W_{build} * \left[\frac{WOB - meanWOB}{meanWOB}\right] + R_{build} * \left[\frac{ROP - meanROP}{meanROP}\right] + P_{build} * \left[\frac{Pressure - meanPressure}{meanPressure}\right]$$

$$+ F_{build} * \left[\frac{Flow - meanFlow}{meanFlow}\right] + M_{build} * \left[\frac{RPM - meanRPM}{meanRPM}\right] + T_{build} * \left[\frac{Torque - meanTorque}{meanTorque}\right]$$

$$+ I_{build} * \left[\frac{\sin Inc - mean\sin Inc}{mean\sin Inc}\right] + K_B * [BuildDemand\%] + C_{BT} * [TurnDemand\%] + build_{bias}$$

and

$$Turn = W_{turn} * \left[\frac{WOB - meanWOB}{meanWOB}\right] + R_{turn} * \left[\frac{ROP - meanROP}{meanROP}\right] + P_{turn} * \left[\frac{Pressure - meanPressure}{meanPressure}\right]$$

$$+ F_{turn} * \left[\frac{Flow - meanFlow}{meanFlow}\right] + M_{turn} * \left[\frac{RPM - meanRPM}{meanRPM}\right] + T_{turn} * \left[\frac{Torque - meanTorque}{meanTorque}\right]$$

$$+ I_{turn} * \left[\frac{\sin Inc - mean\sin Inc}{mean\sin Inc}\right] + K_T * [TurnDemand\%] + C_{TB} * [BuildDemand\%] + turn_{bias}$$

[c4] 4.A method as claimed in Claim 1, wherein an output

signal is produced which is used to control a display on which the predicted reachability ellipse diagram is displayed to provide an operator with information for use in controlling the operation of the drilling system.